Granite–greenstone associations of the Yamarna – Irwin Hills region, northeastern Goldfields: the broader context

by

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New 1:100 000-scale mapping in the northeastern portion of the Eastern Goldfields region will complete the coverage of the exposed part of the Archean Burtville Terrane of the Eastern Goldfields Superterrane (Cassidy et al., 2006). The new mapping includes four substantial greenstone belts: Ulrich Range, Mount Venn, Irwin Hills – Lake Lightfoot, and Yamarna – Mount Gill; and three minor belts: Mount Sefton, East of Mount Hickox, and Dorothy Hills (Fig. 1). All greenstones have been metamorphosed under greenschist- or amphibolite-facies conditions. In the scheme of Cassidy et al. (2006), greenstones in areas covered by the new mapping lie within the Merolia and Yamarna Domains of the Burtville Terrane (Fig. 1). These domains have not been comprehensively characterized and described previously.

Merolia Domain

The Ulrich Range greenstone belt is a predominantly mafic to ultramafic succession. Pillow structures in basalts show that the belt is folded, with at least one locally preserved, northwesterly trending anticline. Minor volcaniclastic and siliciclastic sedimentary rocks outcrop in the core of the anticline. Discontinuous chert bands between basalt units are typically less than 40 cm thick, and are commonly folded. The belt is intruded by microgranite sheets, one of which yielded a SHRIMP U–Pb zircon age of 2667 ± 5 Ma.

The Mount Venn greenstone belt contains folds at various scales up to 2 km wavelength, commonly separated by shear zones, which may form a greenstone belt-scale synclinorium. The lowermost greenstones are mafic–ultramafic volcanic rocks, with minor sedimentary interbeds that include chert and banded iron-formation. The former are intruded by ultramafic and mafic sheets, which thicken significantly to the north. The mafic–ultramafic-dominated part of the succession is overlain by sedimentary rocks dominated by felsic volcaniclastic rocks. Higher in the succession, the volcaniclastic rocks are interbedded with andesitic flows that are intruded by dolerite. The volcaniclastic rocks are overlain in turn by a series of rhyolitic and dacitic lavas. Zircons from a rhyolite yielded a SHRIMP U–Pb age of 2770 ± 3 Ma, which is within error of the previously obtained age of c. 2679 Ma for volcaniclastic rocks in the same belt. The uppermost preserved part of the succession is intruded by layered gabbros of the Mount Venn intrusion.

Rocks of the Irwin Hills – Lake Lightfoot greenstone belt are sheared by layer-parallel structures, folded, and intruded by granite. The belt contains dominantly mafic rocks, with abundant ultramafic and sedimentary rocks. The mafic rocks are typically basalt, including pyroxene spinifex-textured basalt, and dolerite. Ultramafic rocks occur throughout the sequence, but form at least one continuous unit along the western side of the belt. Sedimentary rocks include shale, sandstone, chert and banded iron-formation, and are found at all levels. Ridges of ferruginous chert and banded iron-formation are prominent along the western side of the belt, and also define large-scale folds in the north. At the northwestern end of the belt, a gabbro lens forms the Irwin Hills. The relationship between felsic volcaniclastic rocks in the southern part of the belt, immediately west of the Stella Range, and the rest of the sequence is not clear. However, these rocks are similar in character to the c. 2770 Ma volcaniclastic rocks in the Mount Venn greenstone belt.

Yamarna Domain

The Yamarna Domain is separated from the Merolia Domain by the north-northwesterly trending, regional-scale Yamarna Shear Zone, which is characterized by medium- to high-grade, strongly sheared rocks. Common L>S tectonites, S-C foliation, extensional shear bands, and asymmetric clasts indicate both sinistral and dextral shearing.

The Yamarna – Mount Gill greenstone belt is dominated by a mafic succession with minor ultramafic, clastic sedimentary, and chert components. To the south it

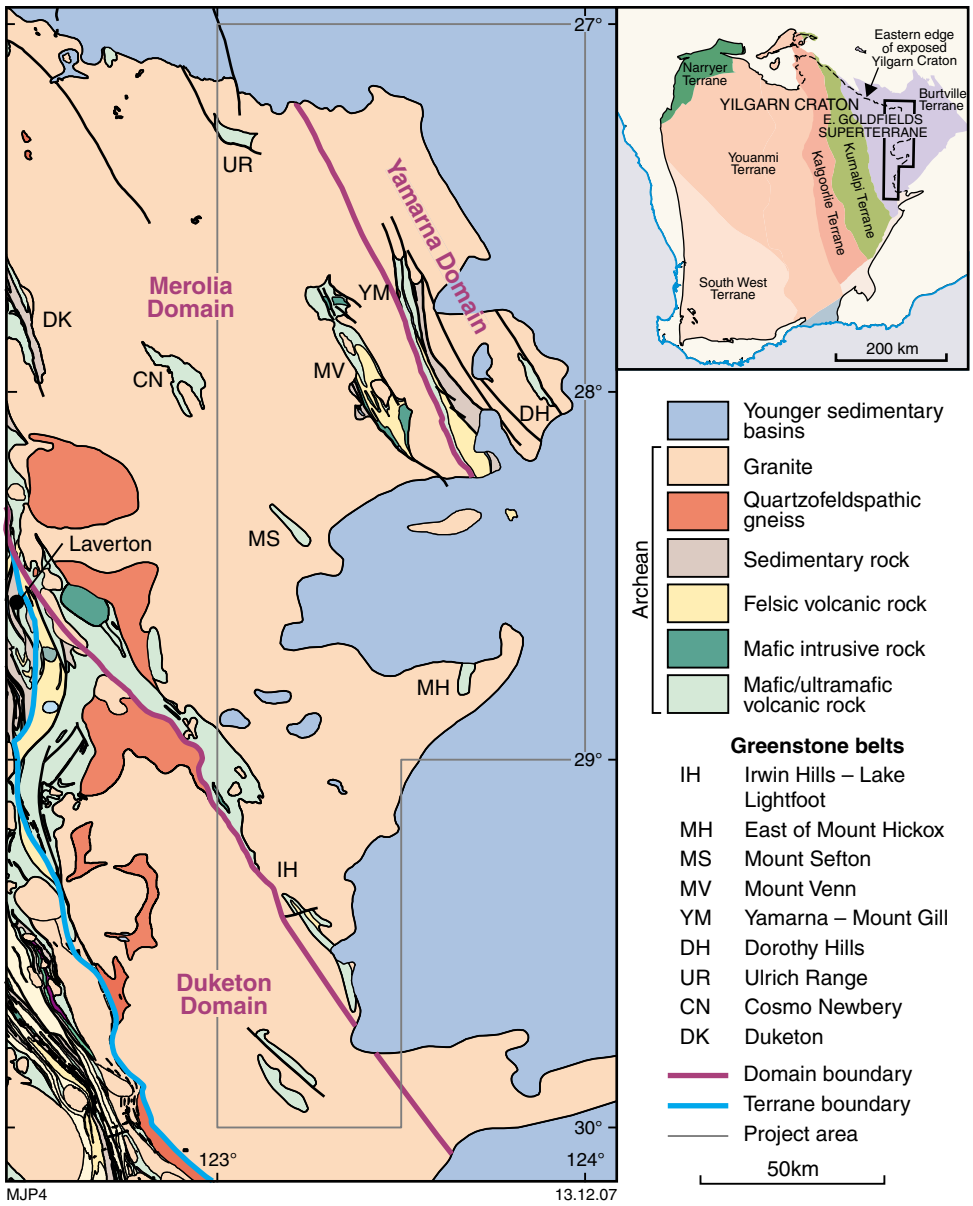

Figure 1. Geological map of the northeast Yilgarn Craton showing the area of current mapping (modified from Tyler and Hocking, 2006). The greenstone belts referred to in the text have been labelled. The inset shows the tectonic division of the Yilgarn Craton (modified from Cassidy et al., 2006)

contains a lens of felsic volcanic and volcaniclastic rocks. Graded bedding in the volcaniclastic succession indicates it youngs to the east. There are no geochronological data for this greenstone belt.

The Dorothy Hills greenstone belt in the east consists of predominantly fine- and medium-grained mafic rocks and, although primary basaltic textures such as amygdales and volcanic breccias are locally preserved, the younging direction is uncertain. Minor pelitic sedimentary rocks are interbedded with the mafic rocks.

Regional context

The western part of the Burtville Terrane was recently interpreted as a complex amalgamation of volcanic successions and sedimentary basins that accreted to the Kurnalpi Terrane of the Eastern Goldfields Superterrane (Fig. 1) at c. 2665 Ma (Standing, in press). However, the relative disposition of domains and terranes in the western Burtville Terrane is a matter of ongoing discussion (cf. Cassidy et al. (2006) and Barley et al. (2002)).

The Duketon Domain was assigned to the Burtville Terrane (Cassidy et al., 2006) partly on the basis of a c. 2805 Ma age on felsic rocks in the Duketon greenstone belt (Kositcin et al., in press). New GSWA geochronology shows that the Merolia Domain of the Burtville Terrane contains c. 2770 Ma felsic volcanic and volcaniclastic rocks — the same age as the precursors to gneiss (Fletcher et al., 2001) and migmatite (Dunphy et al., 2003) from the Duketon Domain.

The volcanic and plutonic rocks of the Burtville Terrane are older than any rocks yet dated elsewhere in the Eastern Goldfields Superterrane, apart from locally preserved enclaves interpreted as older basement within the Kalgoorlie Terrane (Kositcin et al., in press). Together, these ages suggest that the Burtville Terrane may have an affinity with similarly aged rocks in the Youanmi Terrane (Fig. 1).

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